LABORATORY Spotlight
The National High Magnetic Field Laboratory
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Wide Bore 900 MHz Project Bucket Test

The wide bore 900 MHz project will soon be tested in the bucket cryostat in Cell 16 of the NHMFL DC Field Facility to verify performance of the magnet assembly and allow for any minor adjustments that may be required prior to installation in its final cryostat. Shortly thereafter, the magnet will be placed into the final cryostat and installed in the NMR wing of the laboratory.

The four critical performance parameters of an NMR system are (1) the maximum operating field, (2) the rate of decay of the field, commonly referred to as the persistence, (3) the field homogeneity over a specified volume at the bore center of the magnet and (4) the cryogenic hold time or the time allowed before the cryogens must be refilled. The object of the bucket test is to verify the basic operating parameters of the magnet in a cryostat that can be readily opened. This provides an opportunity to demonstrate magnet operation and go through the training period of the magnet in an operating environment that will allow relatively easy access to the magnet if trouble is detected. The bucket test is, of necessity, somewhat limited, particularly in the operating temperature to be achieved. The magnet is designed to operate at 1.8 K in the permanent cryostat. The bucket test, due to limitations in the size of the cryostat and the desire to maintain a facility that permits relatively easy access to the magnet, will achieve an operating temperature of about 2.2 K. After a successful bucket test, the magnet will then be installed in the permanent cryostat, which is welded together to minimize the potential for vacuum leaks that would affect the long-term operation of the magnet.

Because of the operating temperature limitations and the magnetic environment of Cell 16, the bucket test will not necessarily demonstrate the final operating specifications of the magnet. The margin in the critical current of the magnet will allow us to reach very close to if not achieve the design maximum operating field of the magnet. The bucket test conditions should show demonstration of magnet persistence, but the magnetic background environment in Cell 16 may not permit demonstration of the final spatial homogeneity. Finally, the cryogenic hold time is a performance parameter of the final cryostat and will not be verified in the bucket test. The bucket test will also demonstrate the operation of all the auxiliary systems, such as the bucking coils, the quench heater system, the superconducting shim system, the quench detection system, and the magnet operating and control systems.

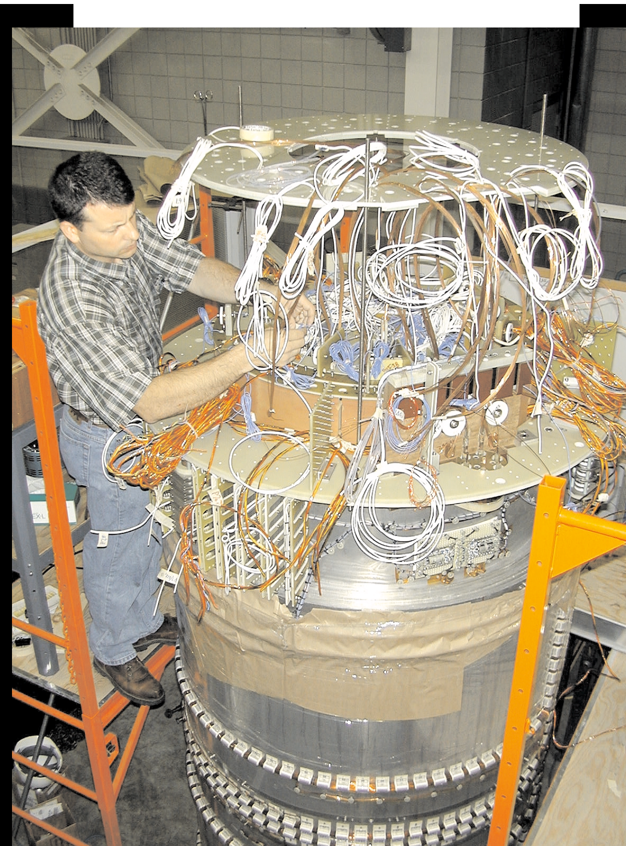

Figure 1. The final wiring on the 900 MHz magnet assembly is presently being completed.

The bucket test comprises three main systems: the magnet assembly, the cryogenics, and the instrumentation/quench detection. The progress and present status of these are described below.

The magnet assembly has seen much progress since last summer including receipt of the five NbTi coils and superconducting shim set from Intermagnetics General Corporation, final fabrication of the five Nb_3Sn coils here at the NHMFL, completion of the production of the superconducting switches, diode packs, shunt resistors, bucking coils, and all the other hardware required for magnet assembly. Presently, the magnet is undergoing its final wiring as shown in Fig. 1. The cryogenic system comprises the baffle assembly (shown being assembled in Fig. 2), the bucket cryostat, helium liquefier, and vacuum system. All of these systems have been designed, hardware procured, and are in the final stages of assembly. The instrumentation and quench detection system comprises (1) the fuse boxes to isolate the operators from possible high voltages coming from the magnet assembly, (2) two quench detection systems, one main and one redundant, which detect unsafe, non-superconducting voltages and trigger the quench heaters to safely discharge the magnet, (3) various power supplies, including capacitive power supplies to power the quench heaters, and (4) the computers required to collect and record all the instrumentation on the magnet assembly. All of these systems have been designed, hardware procured, and are in the final stages of assembly.

Only a few tasks remain before the bucket test can begin. After the wiring is completed on the magnet assembly, it will be connected to the bucket test baffle system, followed by quality control checks of the wiring. Next, the instrumentation and quench detection systems will be connected, followed by more checks. Finally, the magnet will be inserted into the bucket cryostat and cooldown to operating temperatures will commence.

We look forward to a successful test and the commissioning of this very unique ultra-wide bore 900 MHz NMR magnet.

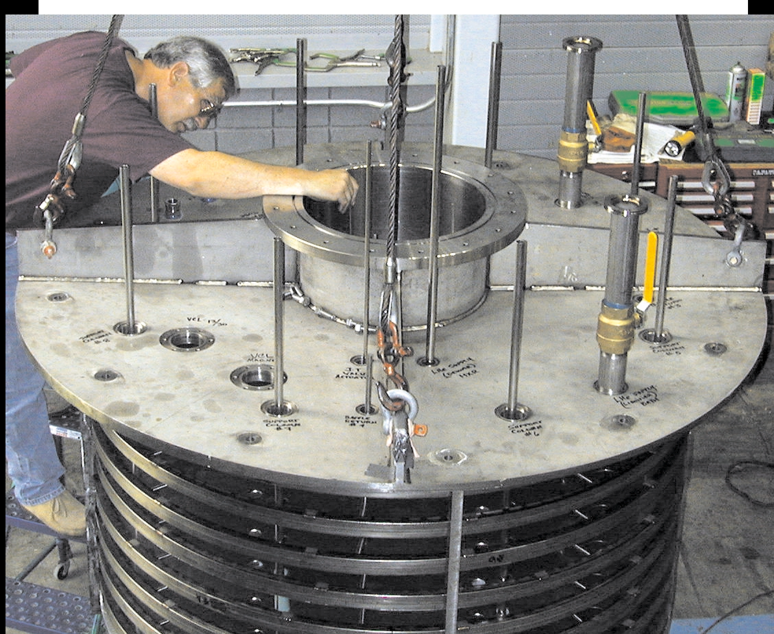

Figure 2. The bucket test baffle system is shown here undergoing its final assembly.

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